Space Weather Technical Forecast

Issued on Saturday, 14 October 2023 at 13:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Current fast wind from CH58/- gradually reducing through the UTC weekend. Likely rising Chance of M-class flares. Fast wind from CH60 may arrive early next week, with a Chance of G1/Minor Storm.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low in the past 24 hours, although an isolated impulsive C9.8 flare was observed at 14/0515UTC from AR3460. There are currently seven numbered sunspots on the visible disc. Only small changes in spot evolution have been observed in recent imagery. The largest region in areal extent is AR3466 (Cho/Beta) in the northeast, with the most magnetically complex AR3460 (Dao/Beta-Gamma) in the southwest. Other spot regions are relatively small and unremarkable. Newly numbered region AR3467 is rotating around the east limb, and has tentatively been classified although limb proximity continues to make analysis difficult at present.

No Earth-directed CMEs have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1 rose erratically from 400 to 500km/s, to largely above 500km/s after 13/2145UTC with a peak 548km/s. Solar wind density occasionally peaked above average at first, but reduced to below average levels. The IMF showed a similarly trend, occasionally peaking strong before 13/2130UTC (peak 24nT at 13/1200UTC), before falling to weak levels thereafter. The north-south component also followed the same trend with a peak +22nT at 13/1242UTC, but briefly varied to -15nT. The phi angle was mainly negative (towards the Sun). Geomagnetic activity was Unsettled to Active (Kp 3 to 4) at first, before reducing to Quiet (Kp 1 to 2) after 13/2100UTC.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at Background levels. GOES16 high energy (greater than 2MeV) electron flux was at Normal Background to Moderate levels, peaking around 190pfu at 13/1355UTC. Associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 14/0001UTC was 2.17e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a slightly rising Chance of M-class flares through the four-day period as a result of potential returning regions.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs are currently in the forecast. The current fast wind from CH58 is likely to wane through the UTC weekend. Geomagnetic activity has become generally Quiet, although there remains a chance of Unsettled intervals on Day 1 (14 Oct). By the new working week CH60/+ fast wind may arrive (16 Oct), leading to a Chance chance of G1/Minor Storm.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux will most

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likely remain at Background levels. The high energy electron flux (greater than 2MeV) forecast is expected to be at background to moderate levels on day 1 (14 Oct), with a slight chance of reaching the High threshold from day 2 (15 Oct) as the effects of the fast wind from CH58 wane. Fluence is expected to follow a similar trend but should remain below the Active threshold throughout.

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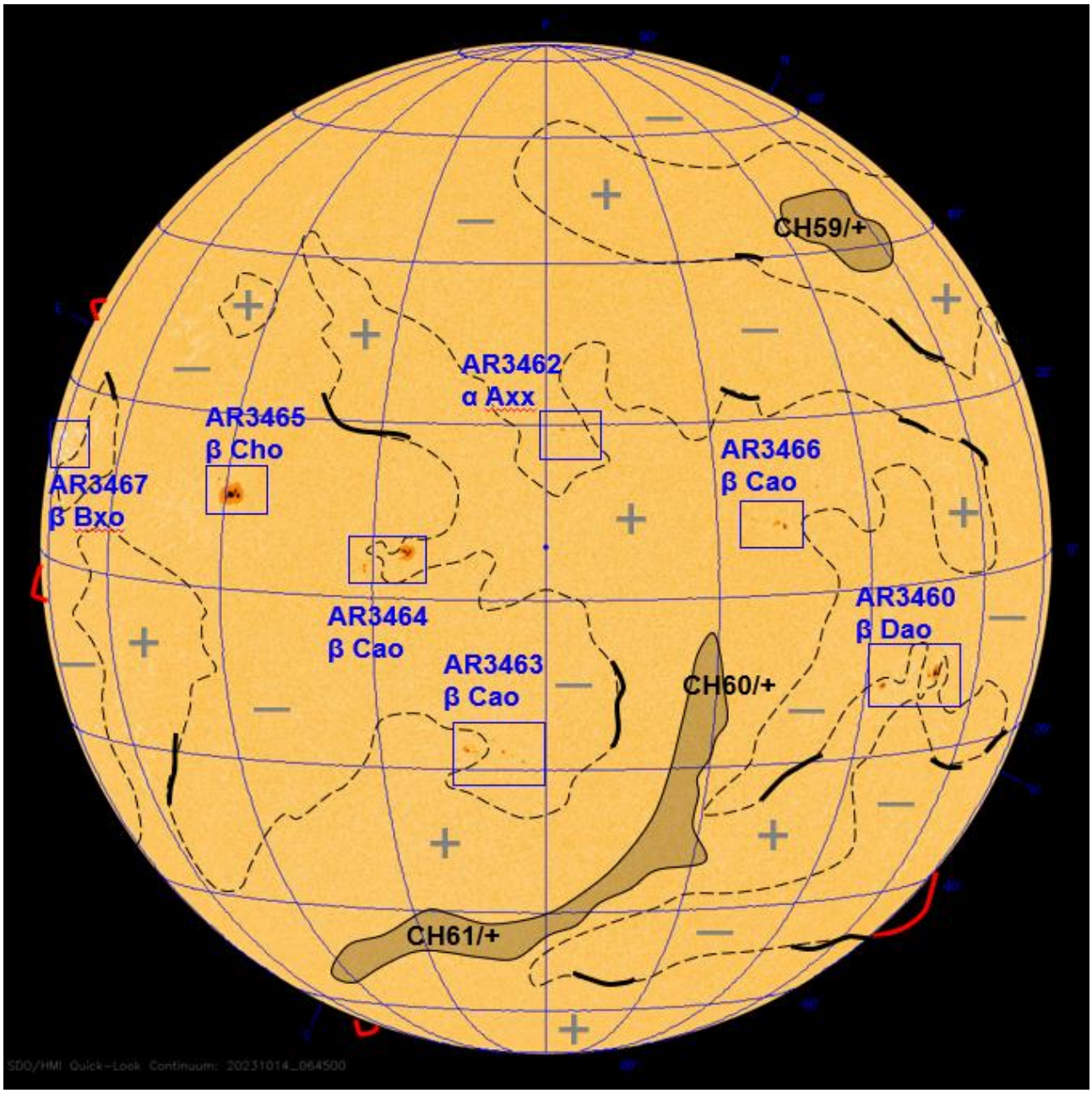
Figure 1. Solar Analysis Valid 14/0700UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

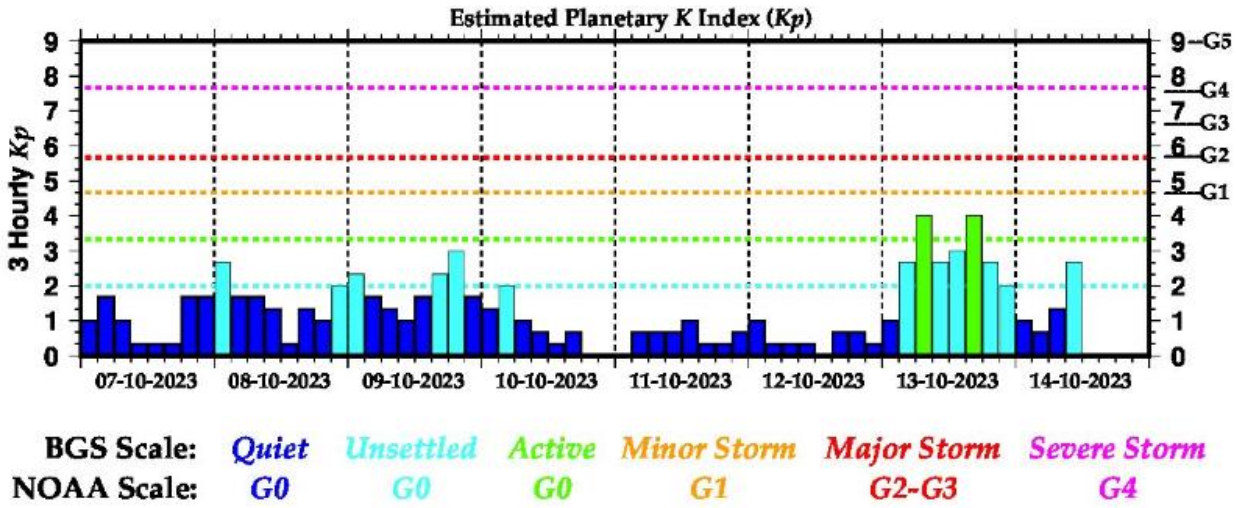
No Earth directed CMEs are currently in the forecast.

Solar winds are currently at slightly elevated levels, around 480km/s, due to ongoing influence from CH58/-. Geomagnetic activity has now settled at Quiet levels, although there is still the chance of occasional Unsettled activity on Day 1 (14 Oct). The next potential fast wind could originate from CH60/+ and may arrive on Day 3 (16 Oct), with a Chance of G1/Minor Storm, before activity begins to gradually wane on Day 4 (17 Oct). There is some uncertainty in the latter part of the forecast however, as Enlil appears to show any faster winds missing Earth, and persistence was contaminated by CME effects on the last rotation.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	30	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Figure 2: BGS estimated Planetary K Index (Kp) over the past 7 days



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Radio Blackouts - X-Ray Flares:

An isolated impulsive C9.8 flare was observed at 14/0515UTC from AR3460. Mostly Low solar activity is expected, but with a Chance of isolated M-class flares.

There are currently seven numbered sunspots on the visible disc. Only small changes in spot evolution have been observed in recent imagery. The largest region in areal extent is AR3466 (Cho/Beta) in the northeast, with the most magnetically complex AR3460 (Dao/Beta-Gamma) in the southwest. Other spot regions are relatively small and unremarkable. Newly numbered region AR3467 is rotating around the east limb, and has tentatively been classified although limb proximity continues to make analysis difficult at present.

Several potential returning regions through the period give the likelihood of a slight rising Chance of M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	30	40	40
Very Active	R3 to R5 X Class	No	1	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is most likely to persist at Background levels. There remains a Slight Chance of S1/Minor Solar Radiation Storms throughout the period, should any suitable larger flares occur.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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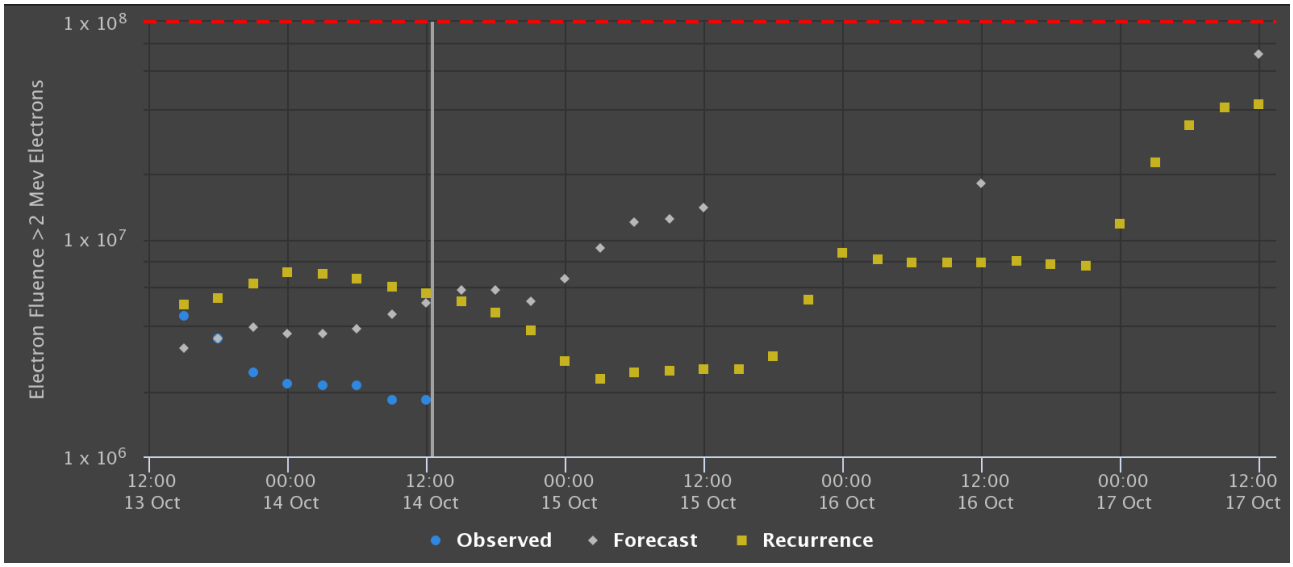
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux is at Normal Background to Moderate diurnal variation at present, probably rebounding at GEO later in the UTC weekend, with a Chance of reaching High. The end of the four day period may again see reduced electron counts at GEO, as the next potential high speed stream reaches Earth, temporarily suppressing the Van Allen belts.
Fluence is expected to follow a similar trend, rising in the coming days before a possible temporary reduction, but should remain below the Active threshold throughout. The REFM trend and recurrence look a good general guide.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	30	30	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM



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